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cretaries, not heretofore communicated, Dr. Dunglison had been charged with the correspondence of the Society for the present year.

Stated Meeting, Dec. 3.

Present, twenty-five members.

Dr. PATTERSON, Vice President, in the Chair.

Letters were received and read—

From the Massachusetts Historical Society, dated Boston, 18th Nov. 1841; the National Institution, dated Washington, 26th Nov. 1841; H. J. Bowditch, Esq. of Boston, dated 13th Nov. 1841, and the Rev. David Thom, of Liverpool, dated 13th Oct. 1841; transmitting donations to the Society, and acknowledging the receipt of its Transactions and Proceedings.

The following donations were announced:—

FOR THE LIBRARY.

Account of the Anniversary Meeting of the Numismatic Society of London, June, 1841,—and Mr. A. J. Stothard's List of British Medals.—*From the Numismatic Society.*

Esop's Fables in Chinese. By Sloth. (Robert Thom, Esq, British Interpreter, at Canton.) 1840. Fol.—*From the Rev. David Thom.*

The Chemical Catechism, by the late Samuel Parkes, &c. &c. 13th Edition, by E. W. Brayley, Esq. of the London Institution, &c. &c. London, 1834. 8vo.—*From the Editor.*

Address before the Phi Beta Kappa Society of Bowdoin College, 2d Sept. 1841. By Alden Bradford, Esq. &c. &c.—*From the Author.*

Introductory Lecture to a Course on the Principles and Practice of Surgery, in the University of Pennsylvania, Nov. 1841. By William Gibson, M.D. &c.—*From the Author.*

Introductory Lecture to a Course on the Institutes of Medicine, in the University of Pennsylvania, Nov. 1841. By Samuel Jackson, M.D. &c.—*From the Author.*

Mr. Nuttall presented a communication, entitled "Description and Notices of New or Rare Plants, collected in a Journey over the Continent of North America, and during a Visit

to the Sandwich Islands and Upper California, by Thomas Nuttall;" which was read and referred to a committee.

Professor Henry D. Rogers read a communication by his brother, Professor William B. Rogers, and himself, entitled, "Observations on the Geology of the Western Peninsula of Upper Canada, and the Western part of Ohio;" which was referred to a committee.

The authors commence by expressing their views of the importance of determining the relations of the rocks of the western states to the formations of the Appalachian system, as they are developed in New York, Pennsylvania and Virginia. They deem this comparison essential to the full understanding of those gradations in type which elucidate the physical changes that accompanied the production of the strata. The difficulties of the investigation are then alluded to, consisting in these very changes of type, the horizontality of the rocks, the deep covering of drift which so generally conceals them, and the interruption of their range from western New York into Ohio, caused by the waters of Lake Erie.

The direct comparison of the western formation with those of the Appalachian chain being precluded by the changes which the formations undergo in the interval; it was deemed essential to establish, if possible, their relations by a continuous tracing from Pennsylvania through New York, and thence keeping some easily recognised horizon steadily in view, to work round Lake Erie through Upper Canada and Michigan, and by this means form a junction with the strata of Ohio.

Range of the Niagara Limestone.—In following some of the formations of the Niagara River, through Upper Canada, the course of the Niagara limestone, which forms the escarpment of the mountain ridge, was traced westward from Queenstown to the head of Lake Ontario. It then sweeps round the head of the lake, and again changing its strike, takes a N.N.W. direction to the southern end of Lake Iroquois, or Georgian bay of Lake Huron. A section of the formation is then given in the neighbourhood of Ancaster, about fifty miles west of Niagara. It shows a slight change in the lithological character of some of the strata, accompanied by an increase of thickness of the general mass as traced westward.

The Gypsum Shales are then traced in a belt south of the terrace, and shown to intersect the Welland Canal, and to follow the course of Grand River to the vicinity of Paris. From this point they strike north with the mountain ridge, and passing a little east of Guelph,

stretch northward towards the southern end of Lake Iroquois. At Paris some of the beds contain the characteristic hopper-shaped cavities. The well-marked vesicular or pitted limestone of the top of the formation is likewise found here.

The Vesicular Limestone is next described and traced. This is a buff coloured, impure subcrystalline limestone, distinguished by its peculiar lenticular cavities. Being remarkable for the constancy of its features and its extensive range, it proved of great importance in ascertaining the super-position of the more variable strata that adjoin it, and was thus used as a horizon from the Niagara river through Upper Canada into Michigan and Ohio. It was traced northward, from Paris to the vicinity of Guelph, and was shown to lie below the south branch of the Thames at Beachville, but to immerge in the north branch of the same river about 40 miles above London.

On the Maitland river near Lake Huron, it is well exposed, with a group of overlying limestone. Though destitute of fossils, it was readily identified at all these points.

The Rocks overlying the Vesicular Limestone in Upper Canada are stated not to accord exactly with those which repose upon this rock in New York. The important changes which this part of the series undergoes in passing from the central counties of that state to the districts west of the Genesee, being first shown by citations from the annual reports of Mr. Vanuxem and Mr. Hall, evidence was afforded of still further modifications in Upper Canada. An opinion was expressed that the corniferous and Onondaga limestones thin out entirely before crossing the peninsula to Lake Huron, and that the hydraulic and Seneca limestones must likewise vanish, or greatly change their type. On the Maitland river, near Goderich, where there is a well exposed section; the vesicular limestone forming the bottom of the group; none of the formations seen east of Buffalo could be recognised. In a section of the strata exposed in the cliffs of the Maitland, the pitted rock is described as immediately overlaid by dove coloured and bluish limestone, sometimes of a sparry texture, abounding in fossils. No attempt was made to determine with precision the relations of this formation to the strata of western New York, as no instance occurred where it was found in company with the Onondaga rock or its associates; but the opinion is expressed that it occupies a position high among the limestones which underlie the Marcellus shales. One reason for so placing the Maitland rock, is its obvious identity with the limestone of Sandusky, the infraposition of which to the Marcellus shales can readily be shown. This identity is made to rest on a comparison of fossils, and on an actual tracing of the pitted

rock and the Maitland limestone from Canada round the head of Lake Erie. Another motive for thus referring the Maitland rock, is found in the affinity which prevails between its fossils and those of the Onondaga, Seneca and Marcellus strata. Of the species examined, it contains in common with those formations, *atrypa affinis*, also an *atrypa* common at Schoharie, *strophomena lineata*, a *delthyris*, common to the Onondaga limestone and to the shales next above that rock in Pennsylvania (Marcellus shales); also *cyathophyllum ceratites*, and a trilobite of the Onondaga limestone. Though these links indicate a somewhat near approximation in date, they are not regarded as proving the rock an equivalent of any of the formations mentioned. None of the organic remains are characteristic of any of the strata lower than the Onondaga limestone. What seems most conclusive however of the high position of the Maitland stratum, is its identity with the limestone of Sandusky, the plane of which is but little under the horizon of the Marcellus shales.

Rocks of the Detroit River, and of the western end of Lake Erie.

The persistence of the pitted rock through Upper Canada being ascertained, the next point was to discover the relations of it and the overlying limestones to the strata widely developed about the head of Lake Erie. Uniting the facts collected of the dip and range of the strata in Upper Canada, with the statements contained in the annual reports of Dr. Houghton, the State Geologist of Michigan, it was inferred that a gentle axis of elevation passes in a south-south-west direction near the lower end of Lake Huron, forming the northern portion of that broad anticlinal rise of the rocks which divides the upper formations of Ohio from their equivalents in Indiana. It was therefore suspected that the pitted limestone and other strata would depart from their north-western strike, seen in Canada, and range in obedience to this axis towards the south-south-west. Should such be the case, it was hoped to unite by actual tracing the rocks of Michigan and Ohio with those of Canada and New York. Pursuing the formation south-westwardly by the borders of Detroit river, Lake Erie and the Maumee, these anticipations were realized.

The Fossiliferous Rocks of the Detroit River, both in Canada and Michigan, are readily identified by their composition and organic remains with the limestones which overlie the pitted rock on the Maitland. But the pitted rock itself in Gros Isle, at the mouth of the Detroit river, in a position proving its immediate subjacency to these strata, fortunately places this identity beyond a doubt. It is an arenaceous cream coloured limestone, abounding in the characteristic

lenticular cavities, and as usual destitute of organic remains. Its elevation above the level of the river cannot exceed eight feet: its extremely slight dip towards the north-west is perceptible.

The overlying limestones are well seen on the western side of the river, one mile from the village of Truago in Monguagon. The most common variety of the rock at this place is a light grey, somewhat sparry limestone, which becomes yellowish and mealy by weathering. It strongly resembles the limestone of the Maitland, and that seen in the bed of the Thames at Beachville. It has an inconsiderable dip towards the north-west. The same strata are displayed in a series of quarries on the Canada side, about two miles from Malden. The dip here is scarcely noticeable: if any prevails, it is westward. The Truago and Maldon beds manifestly overlie the vesicular rock of Gros Isle, and agree in their fossils with the similarly placed limestone of the Maitland. They contain strophomena lineata, another strophomena, atrypa affinis, also another atrypa, septæna, orthoceratites, cyathophillum, ceratites, favosites, encrini, a trilobite, and several fossils not yet determined.

Rocks of the Maumee River and of Sandusky Bay.—On the Maumee, in Ohio, the pitted limestone is again met with, under features identical with those of the rock seen at Gros Isle and Goderich. Its occurring thus so exactly in a line with the two last named places, goes unequivocally to establish the anticlinal axis supposed to pass from the western part of Canada into Ohio. This axis crosses Lake Erie probably about midway between the head of the lake and the chain of islands stretching from Point du Playe to Point Sandusky. An examination of the fossils of the Sandusky limestone establishes beyond a question its identity with the formation exposed at Malden, Truago and Goderich. This agreement is the more interesting, since the Sandusky rock, under the name of the cliff limestone of Ohio, has by some geologists been regarded as the equivalent of the European carboniferous or mountain limestone. But an inspection of its organic remains shows that its closest foreign relations are to the Wenlock limestones of the English silurian strata. There exists moreover in Tennessee and Virginia a higher limestone, not seen in Ohio or New York, much more accurately referrible to the European mountain limestone, and so regarded by Prof. Troost, in his annual reports and other communications on the geology of Tennessee. This rock, characterized by its oolitic structure, and the beautiful genus pentremites, seems, from the descriptions given, to overlie the cliff limestone of Ohio.

The extensive anticlinal line, traced from the western side of Canada to the Maumee, crosses the Ohio river somewhere in the vicinity of Louisville, and terminates probably in Kentucky, imparting a general south-south-west strike to all the strata of western Canada, eastern Michigan, Ohio and Indiana. The lowest formation near Lake Erie which the axis elevates to the surface, is the pitted limestone. But further to the south-south-west, still lower formations appear; the cliff limestone, at the base of which we place the pitted rock, being underlaid, according to Dr. Locke, by marly shales, that rest upon an extensive formation of blue limestone, well exposed around Cincinnati. These shales are regarded by the authors of the paper as representing the gypsum shales of New York. Influenced by a certain degree of correspondence in the fossils of the Cincinnati limestone, and by other considerations, they view this latter formation to be approximately contemporaneous with the Niagara or Lockport limestone, but to include beds nowhere met with in New York. Apart from the indications afforded by the fossils, a reasonable inference is drawn from its progressive thickening westward, that it ranges at least as far as the axis on the Ohio. The Cincinnati limestone, occupying the same position below the shales under the pitted limestone, as the Niagara formation, may, if we use the term with proper restrictions, be regarded as its equivalent. In thus viewing the limestone of Cincinnati, the authors find their conclusions at variance with those of Mr. Conrad, for whose researches in Palæontology they avow the highest respect. In his last annual report, that geologist regards the limestone of Cincinnati as the equivalent or continuation of the black limestone of Trenton falls in New York. But to bring up a formation so low in the Appalachian series, the anticlinal axis must previously elevate, not only the gypseous and Niagara strata, but the prodigiously thick groups of shales, limestones, slates and sandstones, which rest above the Trenton limestone, and which, if thus elevated, would have conferred upon Ohio, Indiana and Kentucky, a wholly different geology, with a mineralogical character and physical geography unlike those which now belong to them.

In conclusion, a simple generalization is presented of the results arrived at respecting the range and distribution of the Niagara river rocks. The strata overspreading the plain, bounded by the mountain terrace, are conceived to decline gently to the south-west in Upper Canada and Ohio, while the flat but extensive anticlinal axis traverses the slope from Kentucky to the western side of Upper Canada. In these two conditions the authors find a reason, first, for the general

north-western strike of the pitted rock, which carries it in the direction of the mountain terrace to Cabot's Head and the Manitouline islands; and secondly, for that extensive south-western strike, which affects the same stratum in another outcrop as far south as the Maumee, and sends the overlying and next subjacent rocks in a broad zone from Lake Erie across the Ohio river into Kentucky and Tennessee.

Professor Bache called the attention of the Society to a Memorial to the House of Representatives of the U. S., which had been laid on the tables, soliciting the action of Congress to effectuate the reduction of the different Astronomical Observations, which are on the files of the Navy Department, or to be found in the Transactions of different learned Societies of this country; with a view to the determination of the longitude of the Capitol at Washington, and other principal stations in the United States. Professor B. explained the views expressed in the Memorial, and invited for it the signatures of the members.

Mr. Justice mentioned, that recent observations of the moon, made by him with the great telescope at the High School Observatory, confirmed the correctness of Maedeler's map of that satellite in the parts between Aristarchus and Herodotus, which are differently represented by Dermond.

Mr. Lea, from the Publication Committee, presented their annual report, detailing their proceedings during the past year.

The number of Subscribers to the published Transactions, is at this time, 109; there have been 69 copies distributed in exchange with other Societies, &c., and 15 copies sold to non-subscribers. The balance of funds in the hands of the Committee is \$685.12.

Stated Meeting, December 17.

Present, twenty-three members.

Dr. CHAPMAN, Vice President, in the Chair.

Letters were received and read—

From the Royal Academy of Turin, dated 21st Aug. 1841, acknowledging the receipt of the Transactions and Proceed-